Plant density and N response of selected wheat varieties, Yuna. Trial Report 2015

Christine Zaicou-Kunesch, DAFWA, Geraldton Office.

Key messages

1. Frost in September affected grain yield and quality of the short maturity varieties but not the longer maturing varieties Magenta and Calingiri
2. Increasing nitrogen increased grain yield of the longer maturing varieties at each plant density. These responses were not observed in the quicker maturing varieties because of the frost. Magenta was the highest yielding variety at the site.
3. Plant density did not influence the yield of the wheat varieties which were frosted in September.

Introduction

Low rainfall wheat farmers typically use seeding rates in the range 40 – 50 kg/ha, giving crop densities of 80-100 plants/m². In more marginal environments seeding rates may be as low as 30 kg/ha to minimize the risk of crops using too much soil water before grain fill and haying-off in spring. However, this could limit the ability of the crop to respond to good seasons when they occur. It could also limit the potential of crops to respond to N fertilizer in good seasons as well. In choosing seeding rate farmers need to strike a compromise between the risk of crops haying-off when seasonal conditions are poor and missing out on yield potential when they are good. Different wheat varieties can respond to seed rate and N application differently, so there is a need to test these ideas with current wheat varieties.

Aim

To define the nitrogen and crop density responses of current wheat varieties in a low rainfall cropping environment, and their interaction

Trial details

Property	Yuna
Soil type	depth: 0-10 10-40 40-70 70-90 pH ($CaCl_2$): 5.8 5.2 5.5 6 NH_4 (ug/g): 1 <1 <1 <1 NO_3 (ug/g): 9 5 3 4 Total N to 90cm =63kg/ha
Crop	Wheat varieties
Paddock rotation	2014 Canola
Treatments	6 wheat cultivars (Mace, Calingiri, Magenta, Corack, Zen, Supreme) × 4 N rates (0, 10, 30, 50 kg/ha) × 3 seed rates (target densities 60, 120, 180 plants/m²). N rates were applied as 10 kg N/ha at seeding with an

Property	Yuna
	additional 20 or 40 kg N/ha as Flexi-N at mid-tillering to give the appropriate rate. Seed rates were chosen to give the target densities on the basis of seed size and germination percentage, but approximately 30, 60, and 90 kg/ha to give 60, 120, and 180 plants/m² respectively.
Replicates	3
Sowing date	12/5/2015
Seeding rate	See treatments
Fertiliser (kg/ha)	120kg/ha Super CMZ drilled at seeding
Growing season rainfall	371mm : 107mm (Jan-Mar) and 243mm (Apr- Oct)

Results

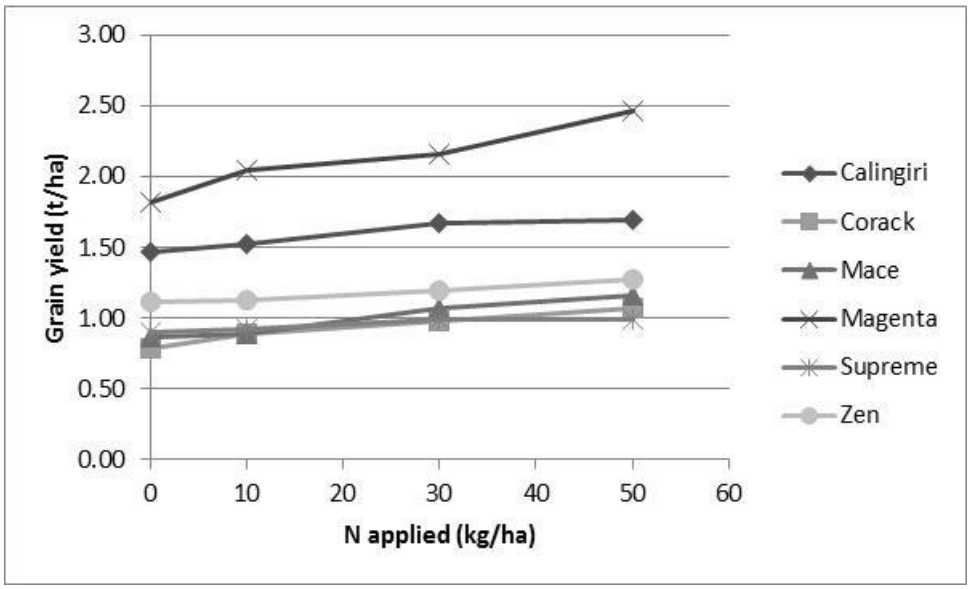

Figure 1: Yield response of six wheat cultivars to increasing plant density at Yuna 2015 (averaged over densities) (LSD= 0.41 (0.13 within variety)

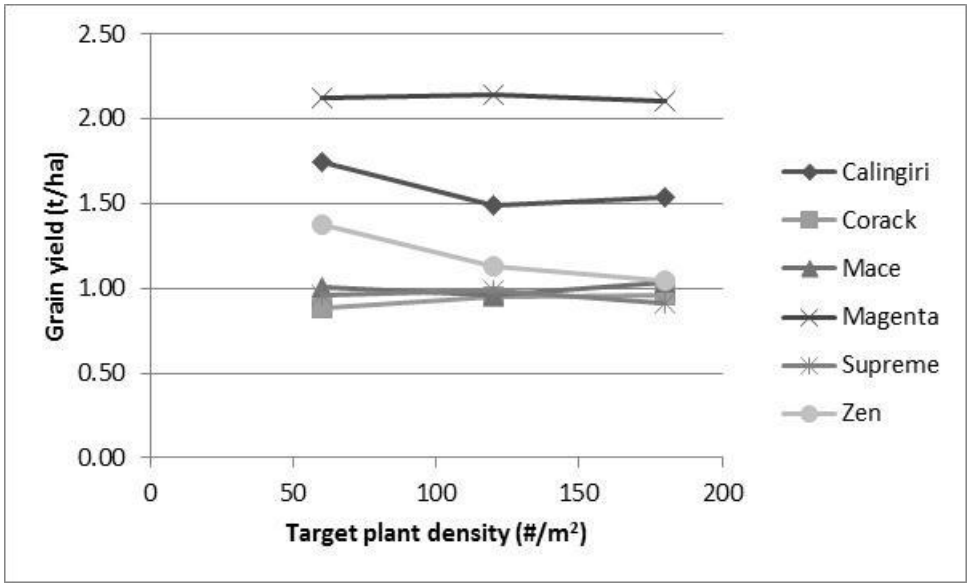

Figure 2: Yield response of six wheat cultivars at increasing plant density at Yuna 2015 (averaged over nitrogen treatments) (LSD= 0.40 (0.12 within variety)

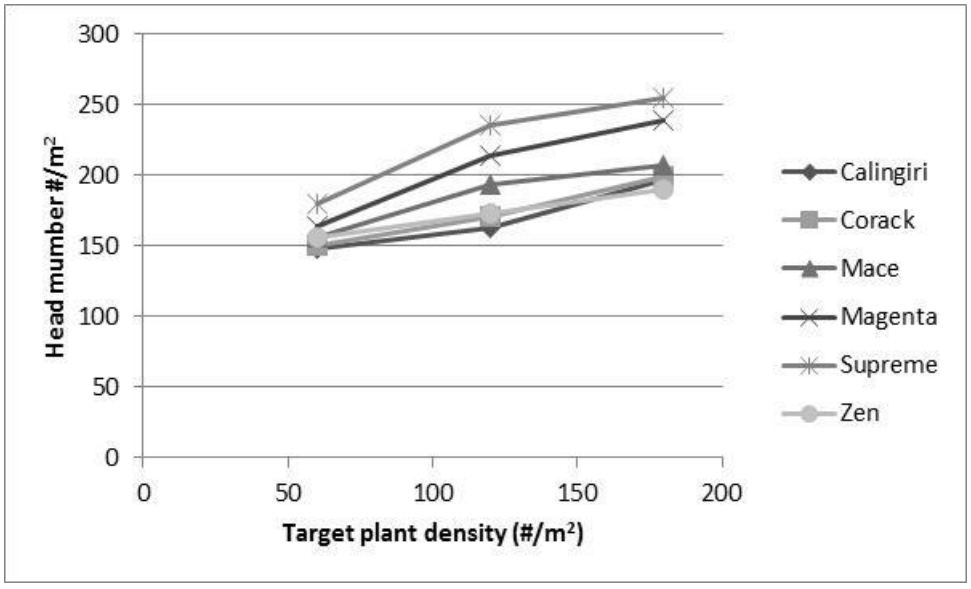

Figure 3: Head numbers of six wheat cultivars at increasing plant density at Yuna 2015 (averaged over nitrogen treatments) (LSD variety x density= 22 (18 within variety)

Table 1: Effect of increasing nitrogen (N kg/ha) and plant densities on grain screenings and hectolitre (kg/HL) of wheat varieties sown at Yuna in 2015. Note Frost affect grain quality and hectolitre was averaged across nitrogen treatment.

Variety	Target Plants (#/m²)	Actual Plants (#/m²)	HLW	Screenings @ N 0	Screenings @ N 10	Screenings @ N 30	Screenings @ N 50
Calingiri	60	58	81	1.9	1.5	1.3	1.6
	120	106	80	1.9	1.7	1.4	1.4

Variety	Target Plants (#/m^2)	Actual Plants (#/m^2)	HLW	Screenings @ N 0	Screenings @ N 10	Screenings @ N 30	Screenings @ N 50
	180	150	80	1.7	1.6	1.4	1.5
Corack*	60	48	64	2.6	2.8	3.4	3.2
	120	92	59	3.1	3.3	3.2	3.3
	180	126	60	3.3	3.6	3.2	3.5
Mace*	60	49	70	3.1	3.1	3.5	3.8
	120	102	65	4.3	4.5	4.0	5.0
	180	137	64	4.8	5.3	4.8	5.1
Magenta*	60	56	83	3.1	2.8	2.8	2.9
	120	119	83	2.8	2.7	2.6	2.6
	180	159	83	3.0	2.7	2.7	2.6
Supreme*	60	46	75	4.7	5.0	5.3	5.3
	120	96	70	6.8	7.5	8.2	8.5
	180	133	68	6.9	7.5	8.5	9.0
Zen*	60	50	80	1.1	1.0	1.0	1.0
	120	102	78	1.1	1.1	1.4	1.6
	180	139	77	1.1	1.4	1.8	1.7
*=PBR		P value	LSD	P value	LSD	Within	
Variety.Srate		<.001	3	<.001	0.9	0.4	
Variety.Nrate		<.001	3	<.001	0.9	0.4	
CV%		2.5		14.3			

Discussion

Assuming 30% of summer rainfall is available for the crop, 80 mm is lost by soil surface evaporation, and a transpiration efficiency of 20 kg/ha/mm, the yield potential at this site was 2.61 t/ha. No variety achieved this yield potential.

The frost in September has affected both grain quality and grain yield. The short – mid maturing varieties Corack, Mace and Supreme had significantly lower grain yields (Figures 1 and 2) with significantly lower hectolitre weights (Table 1). Screenings of these frosted varieties tended to increase with increasing plant density and added nitrogen but this was not evident in Magenta and Calingiri (Table 1)

Both Magenta and Calingiri responded to added nitrogen at each plant density. These responses were not observed in the quicker maturing varieties because of the frost. The total nitrogen in the soil profile (to 90cm) was 63kg/ha (based on soil test).

Plant density did not influence grain yield of Magenta or the varieties which were frosted (Figure 2). The yield of Zen and Calingiri were significantly higher at the lowest plant density (target plant density 60 plants/m^2) than the other two densities. Both these varieties has significantly lower head numbers (Figure 3).

Acknowledgements

- DAFWA colleagues Bob French and Brenda Shackley for trial development
- The Grain Crop Agronomy Reference group (managed by GRDC), for their support with research development in 2015.

- The project 'Tactical wheat agronomy for the west (DAW00249) is funded by GRDC and DAFWA
- Larry Prosser at DAFWA for trial management and Melaine Kupsch at DAFWA for technical support with nitrogen application, data collection and management

Important disclaimer